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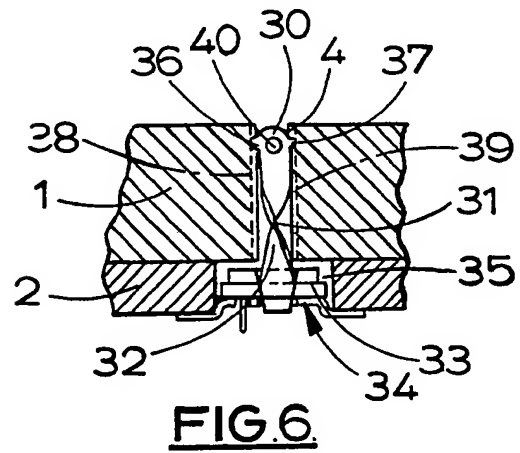
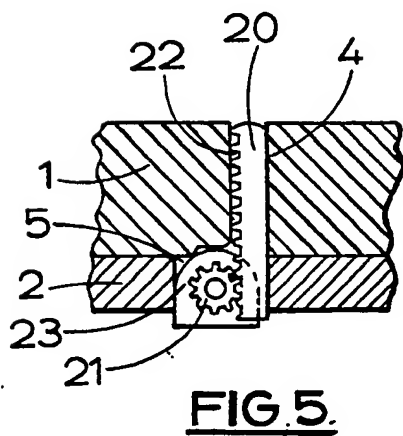
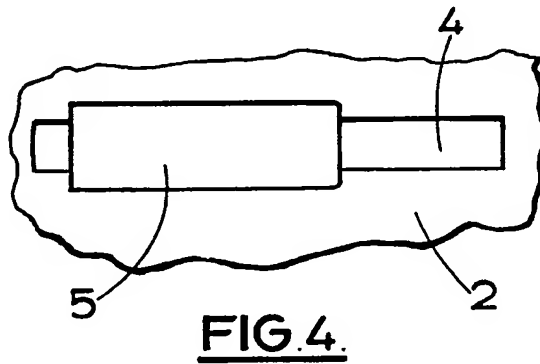
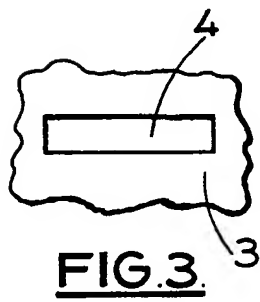
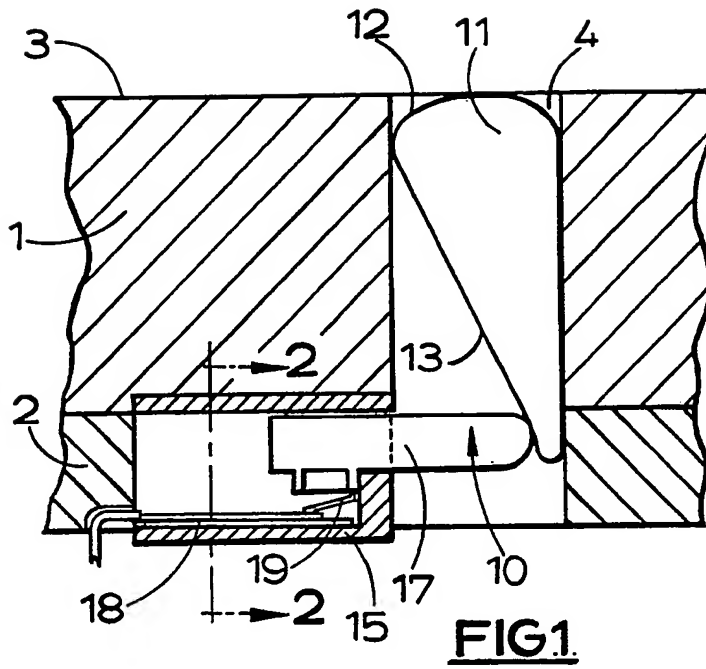
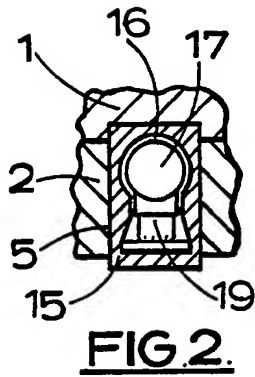
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⁽¹²⁾ UK Patent Application ⁽¹⁹⁾ GB ⁽¹¹⁾ 2 258 704 ⁽¹³⁾ A

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BRAKE LINING WEAR INDICATING MEANS

This invention relates to brake lining wear indicating means particularly for use with vehicle brakes of the kind in which a friction lining has an operative face adapted to be applied to a rotatable braking member, such as a drum or disc, and the indicating means comprises a operating member having an outer end for co-operation with the braking member, the operating member being guided for axial movement in an axially extending bore in the lining, and being adapted to co-operate with a potentiometer of which output signals provide an indication of the status of the brake lining.

On vehicles equipped with an Electronic Braking System (EBS) it is sometimes an advantage to have a continuous indication of brake lining wear so that 'wear equalisation' methods can be employed to generate substantially equal wear on each wheel brake. This has the advantage that overhaul of all the brakes could be carried out at one and the same time when it could be guaranteed that all the linings would be substantially at a minimum condition and therefore require replacement. Additionally, there is also a trend for 'standard' type vehicles to be equipped with proportional wear sensors as opposed to the situation generally pertaining at present in which either no sensor is fitted or the sensor is of a 'switch' type which is adapted to give an output signal only when an individual lining has reached substantially a fully worn condition.

We are aware of EP-A-0 341 404 which discloses lining wear indicating means of the kind set forth. In the lining wear indicating means of EP-A-0 341 404 the

operating member comprises a pin which, at its inner end, carries a spring of cruciform outline for applying a short-circuit between two resistive tracks on a plate, and the tracks are paired together to means providing an indication of the resistance remaining between the wire and the spring as the spring is driven along the tracks by wear of the lining. In the construction of EP-A-0 341 404 the pin is guided to slide in a sleeve which extends through a bore in the lining and through a back plate carrying the lining, and the plate is enclosed within an end cap into which the pin and the spring project and which is mounted on the sleeve with its longitudinal axis parallel to that of the pin.

According to our invention in lining wear indicating means of the kind set forth the operating member acts on the potentiometer through a transmission means.

Conveniently the potentiometer is mounted on the face of the lining remote from the operative face which provides a compact assembly. When the lining is carried by a rigid back plate the potentiometer is housed substantially within the thickness of the back plate. The potentiometer may be insulated from the lining to minimise temperature effects, suitably by the use of a ceramic device.

The potentiometer may be mounted on the lining in a position such that its axis of operation is substantially normal to the axis of the operating member.

The transmission means may be of any convenient construction.

For example the transmission means may comprise a plunger which is guided to slide in a bore. Such a bore may be in the back plate and may have its main axis normal to the direction of movement of the operating member. The bore may retain the operating member against rotation. In such a construction the operating member has an inclined operating face which co-operates with the adjacent end of the plunger. Longitudinal movement of the operating member is accompanied by a corresponding movement of the plunger, in turn to alter the reading of the potentiometer.

In another construction the operating member has an operating face in the form of rack teeth, and the transmission means comprises a pinion which is rotatably mounted in a opening in the back plate on the end of an input shaft for a rotary potentiometer.

In yet another construction the operating member is retained against rotation as it is moved axially in the bore, and the operating member has an operative portion of helical outline defining the transmission means whereby axial movement of the operating member is accompanied by rotary movement of a rotary potentiometer.

Some embodiments of our invention are illustrated in the accompanying drawings in which:-

Figure 1 is a section through a friction pad assembly for a vehicle disc brake incorporating one form of brake lining wear indicating means;

Figure 2 is a section on the line 2-2 of Figur 1;

Figure 3 is a plan of the operative face of the assembly;

Figure 4 is an inverted plan of the assembly;

Figure 5 is a section through a friction pad assembly incorporating another form of brake lining wear indicating means; and

Figure 6 is a section through a friction pad assembly incorporating yet another form of brake lining wear indicating means.

The friction pad assembly illustrated in Figures 1-4 of the accompanying drawings comprises a pad 1 of friction material constituting a lining, and a rigid back plate 2 carrying the friction pad 1. The friction pad 1 has an operative face 3 for engagement with a rotatable braking member in the form of a rotatable disc (not shown).

A slot 4 of oblong rectangular outline extends through the pad 1 and the back plate 2 in a direction normal to the operative face 3.

The slot 4 is also extended to one side in a direction parallel to the operative face 3 for the thickness of the back plate 2 and into the adjacent edge of the friction pad 1 to form a recess 5. The recess 5 is of a width greater than that of the slot 4 and extends laterally for a substantial distance.

Brake lining wear indication means 10 is housed within the slot 4 and the recess 5. The lining wear indicating means comprises an operating member 11 of ceramic material and of a cross section complementary

to that of the slot 4. The member 11 is guided for axial sliding movement in the slot 4. The operating member 11 has an outer nose 12 of arcuate outline which lies tangential to the operative face 3, and an operating face 13 opposite the recess 5 and which diverges inwardly.

A hollow elongate housing 15 of suitable high temperature resistant material, for example ceramic, is located in the recess 5 with its outer end flush with the adjacent wall of the slot 4. The housing 15 houses a linear potentiometer 16, and a transmission member comprising a longitudinally moveable plunger 17. As illustrated the plunger 17 works through an opening in the outer end of the housing 15, and is guided to slide in a part circular bore 18 in the housing 15 adjacent to the inner edge of the recess 5. The outer end of the plunger 17 is of arcuate outline and co-operates with the face 13. The potentiometer 16 extends along the face of the housing 15 remote from the bore 18 and its cursor 19, comprising a spring contact, depends from the plunger 17 in a direction inclined away from the slot 4.

In operation, upon wear of the pad 1 at its operative face 3, the operating member 11 is physically pushed inwardly by the engagement of the nose 12 with the disc. As this takes place the inclined operating face 13 co-operates with the plunger 17 to move it axially of the housing 15 and alter the electrical resistance of the potentiometer.

The action of the inclined operating face 13 is therefore that of translating motion normal to the operative face 3 into motion parallel to that face, thereby producing a low profile, compact device with

the sensing element isolated from the high temperature at the operative face.

In the construction described above different lining thicknesses are catered for by utilising different operating members of a suitable length.

The spring contact 19 provides vertical movement resistance, lateral compliance, and vibration resistance.

The indicating means 10 may be re-usable simply by withdrawing the housing 15 and the operating member 11 from the pad 1 and back plate 2, and re-housing them in another friction pad assembly after first re-setting the potentiometer.

In a modification the slot 4 is of circular outline, and the operating member 11 is of a complementary outline, suitably of pear drop configuration.

In the construction shown in Figure 5 of the accompanying drawings, the operating member comprises a flat strip 20 of high temperature resistant material, for example ceramic, which is guided to slide in the slot 4 which, in this construction, is of circular cross-section. The transmission member comprises a toothed pinion 21 which meshes with rack teeth 22 in the adjacent edge of the strip 20. The pinion 21 is mounted on one end of a rotary potentiometer 23 which is housed in the recess 5.

Displacement of the strip 20 in an inwards direction with wear of the friction lining 1 causes the

pinion 21 to rotate and alter the resistance of the potentiometer.

In the construction shown in Figure 6 of the accompanying drawings the operating member comprises a flat element 30 which is twisted to a 180° or 240° spiral to form a helical portion 31 defining transmission means. The helical portion 31 engages through a rectangular slot 32 in a wiper element 33 of a rotary potentiometer 34 which is symmetrically arranged with respect to the slot 4 in a recess 35 in the back plate 2.

The element 30 is restrained from rotating by a pair of opposed lugs 36, 37 which are slidably received in diametrically opposed grooves 38, 39 in the wall of the slot 4.

As the element 30 is displaced in an inwards direction, the wiper element 33 is caused to rotate thereby altering the resistance of the potentiometer.

An opening 40 adjacent to the nose of the element 30 allows a special tool to be inserted into a partially extended pad assembly in order to pull the element out of the assembly and thereby allow full withdrawal of the assembly.

CLAIMS

1. A brake lining wear indicating means of the kind set forth in which the operating member acts on the potentiometer through transmission means.
2. A brake lining wear indicating means according to claim 1, in which the potentiometer is mounted in a position such that its axis of operation is substantially normal to the axis of the operating member.
3. A brake lining wear indicating means according to claim 1 or 2, in which the friction lining is carried by a rigid back plate and the potentiometer is housed substantially within the thickness of the back plate.
4. A brake lining wear indicating means according to any proceeding claim, in which the potentiometer is insulated from the friction lining to minimise temperature effects.
5. A brake lining wear indicating means according to claim 1, 2 or 3, in which the potentiometer is insulated from the friction lining by a ceramic device to minimise temperature effects.
6. A brake lining wear indicating means according to any proceeding claim, in which the transmission means comprises a plunger guided to slide in a bore.
7. A brake lining wear indicating means according to claim 6, in which the plunger is guided to slide in a bore in the back plate.

8. A brake lining wear indicating means according to claim 6, in which the plunger is guided to slide in a bore in the back plate which is substantially normal to the direction of movement of the operating member.

9. A brake lining wear indicating means according to claim 6, 7 or 8, in which the operating member comprises an inclined operating face which cooperates with the plunger.

10. A brake lining wear indicating means according to claim 1, in which the potentiometer is a rotary potentiometer.

11. A brake lining wear indicating means according to claim 1, in which the operating member comprises rack teeth which co-operate with a pinion attached to the input shaft of a rotary potentiometer.

12. A brake lining wear indicating means according to claim 1, in which the operating member has an operative portion of helical outline defining the transmission means whereby axial movement of the operating member is accompanied by rotary movement of a rotary potentiometer.

13. A brake lining wear indicating means of the kind set forth substantially as described herein with reference to and as illustrated in Figures 1-4 of the accompanying drawings.

14. A brake lining wear indicating means of the kind set forth substantially as described herein with reference to and as illustrated in Figure 5 of the accompanying drawings.

15. A brake lining wear indicating means of the kind set forth substantially as described herein with reference to and as illustrated in Figure 5 of the accompanying drawings.

Patents Act 1977

**Examiner's report to the Comptroller under
Section 17 (The Search Report)**

Application number

GB 9216256.9

Relevant Technical fields

(i) UK CI (Edition K) F2E (EKM)

(ii) Int CI (Edition 5) F16D

Search Examiner

P T SQUIRE

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

Date of Search

20 OCTOBER 1992

Documents considered relevant following a search in respect of claims 1-15

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	EP 0341404 A2 (DAIMLER-BENZ) Whole document	1

SF2(p)

HD - doc99\fil000497

Category	Identity of document and relevant passages	Relevance to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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PUB-NO: DE004226213A1

DOCUMENT-IDENTIFIER: DE 4226213 A1

TITLE: Electronic monitor to measure amount
of wear on brake lining - has wedge in hole through
brake lining displaced as lining wears to operate
potentiometer in brake pad support

PUBN-DATE: February 11, 1993

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APPL-NO: DE04226213

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PRIORITY-DATA: GB09117274A (August 9, 1991)

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EUR-CL (EPC): F16D066/02

US-CL-CURRENT: 188/1.11R

ABSTRACT:

CHG DATE=19990617 STATUS=O>The brake lining (1) has a hole (4) through its entire thickness and through the support plate (2). A wedge (11), with wider

end towards the braking surface (3), inside the hole is displaced as the brake lining thins. The inner end of the wedge displaces the operating slider (10) of a potentiometer mounted in the support plate. A simple circuit computes the brake lining thickness. Thermal insulation mountings for the potentiometer reduce thermal effects from the braking. An alternate design uses a plunger, displaced by brake wear, operating a rotating potentiometer via a rack and pinion coupling. The vehicle braking system can even out the brake wear over a time period, via the computed measurements. ADVANTAGE - Accurate brake wear indication, improved brake management.